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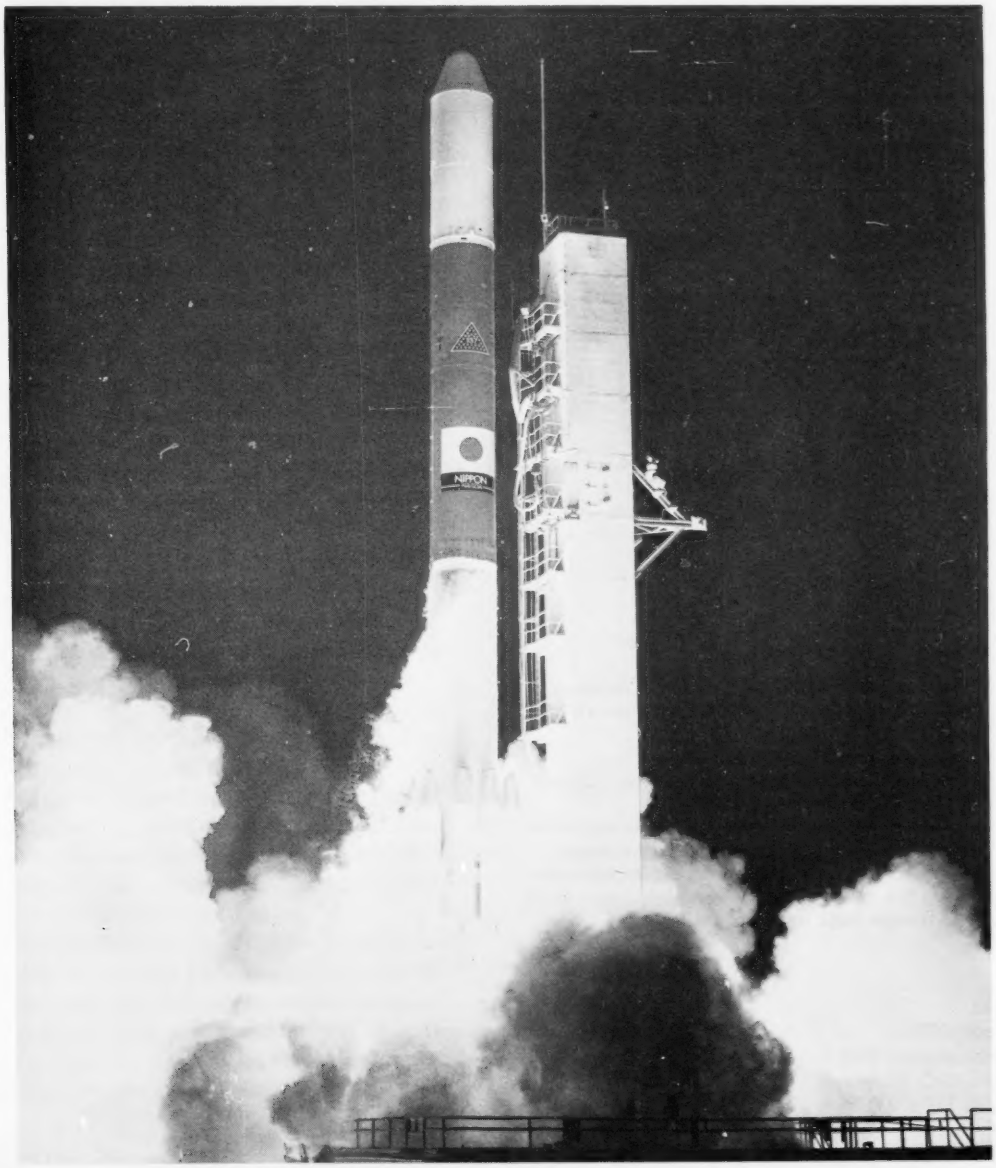

Cover

Japanese Satellite Launched—A Japanese communications satellite was successfully launched from Cape Canaveral on Dec. 14 under the direction of the Kennedy Space Center's expendable vehicles directorate. The experimental satellite is in geosynchronous orbit above the equator at 135 degrees East longitude to provide transmission circuits for telephone and television signals.

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Letter from Washington

Dear Colleagues:

This new year of 1978 begins the third decade of the space age. One of the most significant ways in which the third decade promises to be different from the first two is in the number of nations actively engaged in space activities.

For the first 10 years, our country and the Soviet Union were predominant in the use of space, but by the end of the second decade the European community collectively, several European nations individually, and Japan were seriously involved. In the third decade we will inevitably see more countries active in space and with greatly improved capabilities.

The effect on the United States of increasing foreign space activity is a dichotomy which challenges us on one hand with economic and technological competition, and invites us on the other hand to participate in mutually beneficial cooperative ventures in space. While foreign manufacturers are successfully marketing stations for the reception of data from U.S. earth-sensing satellites, ESA—with Spacelab—is making a $500 to $600 million contribution to our Space Transportation System. At a time when prospective launch systems in Europe and Japan are preparing to compete for business with our own, Canada is providing the $50 million remote manipulator system for the Space Shuttle. And of course our space relationships with the Soviet Union also reflect this dichotomy of competition and cooperation. As 1978 begins, we are exploring with our Soviet counterparts, the possibilities for joint use of the Shuttle and Salyut in a substantial cooperative effort for productive scientific objectives.

I find both elements of this dichotomy healthy and encouraging. As a nation we have always thrived on competition, and any challenge to our technological leadership acts as a constructive stimulant, and conversely, there is a real and growing need for international cooperation in space. Just last October, I had the honor to sign cooperative agreements with the Netherlands on the Infra-red Astronomy Satellite, with the Federal Republic of Germany on the Jupiter Orbiter and Probe, and with ESA on the Space Telescope. Those three agreements in effect provide a contribution totalling about $180 million to our national space program.

In the longer view, international cooperation in space could be a major factor in Man's survival on this earth, with the nations of the world working together to bring the manifold benefits of space to all mankind rather than competing for the finite and shrinking resources of this planet's crust.

Sincerely,

Robert A. Frosch

President Carter Discusses National Science Philosophy and Goals

In late November, President Jimmy Carter enunciated for the first time the national outlook for scientific research and development. His remarks were made at the White House during ceremonies devoted to the annual Medal of Science Awards. The 15 recipients (one award was given posthumously), according to the President's Science and Technology Adviser Frank Press, were chosen from a list of several hundred nominations from all over the country, from institutions and professional societies in all fields of science.

President Carter opened the ceremonies by pointing out that the Medal of Science Awards program was begun in 1959 and that the first award was given in 1962 by then-President Kennedy. In praise of the award winners, President Carter said that he was grateful ". . . to express the appreciation of our Nation for the tremendous present, past and future contribution that you distinguished Americans have earned."

The President pointed out that the government now has the responsibility for preparing the national budget presentation to the Congress after consultation with Science Adviser Press. In a brief discussion of the national science outlook, President Carter said:

"The quality of scientific equipment has been falling off rapidly in recent years. The number of top-ranked research centers has been falling off in recent years. The percentage of faculty members who are scientists and who are also young has been falling off rapidly in recent years.

"In 1968, about 45 percent of the faculty members were young men and women. Now that has dropped off to about only 25 percent; which shows that in the future we have a problem on our hands, unless we take strong action to correct these trends.

"I am assessing each individual agency's budget these days. This afternoon I will have three major agencies to assess. In many instances the heads of those agencies, the Cabinet members and others, have relegated research and development to a fairly low position of priority. But I have directed the Office of Management and Budget to boost those research and development items much higher and they will be funded accordingly.

"Finally, I would like to say that we want to make sure that the climate for research and development in our country is enhanced, with my own imprimatur of approval and interest, with a broad-scale exhibition of interest on numerous occasions by the Members of Congress and my own Administration, with publicity accruing to those who have achieved notably in the scientific and engineering field, and also in direct budget allocations.

"We are not trying to establish nor to maintain a college aid program. I think to the extent that basic research and development commitments can be oriented towards things that improve the quality of our people's lives and enhance the security of our Nation, contribute to our position in world leadership, to that extent these allocations of funds and interests will be more readily acceptable and supported by the American people.

"What we do in science in this country has a tremendous impact on the decisions made in other nations, strong and independent nations, because there is, as you know, a scientific community that is drawn together by mutuality of interest and that is able to transcend obstacles that are raised by national boundaries. And the exchange of information, the consultation, mutual progress, the sharing of responsibility, even between nations like ourselves and the Soviet Union, is one that lays a basis for future peace and understanding and a sharing of a common purpose for humankind."

United States and Soviets Talk about Space

NASA and the Soviet Union's Academy of Sciences held discussions Nov. 14 to 17 in Moscow concerning further cooperation in space. The talks are a result of an agreement reached by NASA and the Soviet Academy of Sciences May 11, 1977, following a meeting of representatives of the two agencies in Washington.

The U.S. delegation was headed by Dr. Noel Hinners, Associate Administrator for Space Science, NASA headquarters. The Soviet Delegation was led by Dr. Boris Petrov, Chairman of the Intercosmos Council of the Soviet Academy of Sciences.

The Moscow meetings were exploratory, aimed at selecting and appraising joint scientific programs for the 1980s that might be mutually advantageous. Emphasis was on fields of study that could take advantage of the different attributes represented by spacecraft such as the U.S. Space Shuttle and the USSR Salyut.

The delegates met as two working groups; one on science and applications, chaired by Dr. Hinners, and one on operations, chaired by Dr. Glynn Lunney, manager of the Shuttle payload integration and development program office at NASA's Johnson Space Center.

The two working groups will seek to fix upon scientific subjects for possible experimentation that might benefit from the flexible delivery capability and large capacity of the Space Shuttle and the capability for longer stay time in orbit represented by the Salyut.

In another U.S.-USSR cooperative space program, the eighth annual meeting of the NASA-Soviet Space Biology and Medicine Working Group was held Nov. 19 to 25 at NASA's Wallops Flight Center. Before the formal meeting, a workshop on simulated weightlessness was held Nov. 16 to 18 in Bethesda, Md. The workshop and meeting are part of a continuing program under the 1971 Science and Applications Agreement between NASA and the Soviet Academy of Sciences.

The meeting focused on biomedical results, including the preliminary results of the Soviet Cosmos 936 flight on which U.S. experiments were flown; a briefing from the Soviets on Salyut 5/Soyuz 19 missions; and a U.S. briefing on a Spacelab missions demonstration test. Participants discussed forecasting man's health state in weightlessness and the research approach to studying space motion sickness.

The U.S. delegation at the formal meeting was headed by Dr. David Winter, NASA director for life sciences. Dr. Rufus Hessberg, director of space medicine, headed the U.S. workshop participants. The Soviet leader at both meetings was Dr. Nikolai Gurovsky of the USSR Ministry of Health.

NASA and Netherlands Agree on Infrared Project

NASA and the Netherlands Agency for Aerospace Programs (NIVR) have entered into an agreement on the cooperative infrared astronomical satellite project. A memorandum of understanding on IRAS was signed last October in The Hague, Netherlands, by NASA Administrator Dr. Robert A. Frosch and A. B. Wolff, Chairman of the NIVR.

The United Kingdom also will participate in the program under a separate memorandum of understanding between the U.K. Science Research Council and the NIVR.

Scheduled for launch in 1981, the Earth-orbiting observatory will employ a cryogenically-cooled infrared telescope furnished by the United States, a spacecraft built by the Netherlands, and a spacecraft command, control and data acquisition facility supplied by the United Kingdom. All three nations are participating in the furnishing of scientific instrumentation and in the observing program.

The IRAS mission, involving nearly 500 scientists, engineers and technicians of the three nations, will conduct the first astronomical survey of the entire sky at those infrared wavelengths undetectable by Earth-based telescopes because of the obscuring effects of the atmosphere.

NASA will design and build the infrared telescope, and provide the Delta launch vehicle and launch services. The Netherlands will provide the spacecraft. Integration of the two systems will take place in the Netherlands.

The satellite will be launched into a polar orbit from the U.S. Western Test Range in early 1981. IRAS has a projected one-year lifetime in which to perform the scientific mission.

NASA's Ames Research Center has management responsibility for the telescope system, which will be built by Ball Brothers Research Corp., Boulder, Colo. NASA's Jet Propulsion Laboratory has overall U.S. project management responsibility. The Dutch effort will be managed at NIVR Headquarters in Delft, the Netherlands, and the British participation will be at Appleton Laboratory near London.

Navy Divers Aid Space Shuttle Preparations

"The rest of the Navy is looking at us with envy," said Chief Petty Officer Richard Wiebe, a U.S. Navy master diver now assigned to duties in the neutral buoyancy simulator at NASA's Marshall Space Flight Center.

He was speaking for a crew of five Navy divers who are on loan to NASA by the Department of Defense to support testing in simulated weightlessness for the Space Shuttle program. All five were fleet salvage divers for the Navy and have had from 5 to 17 years experience with various kinds of diving equipment including scuba, hard hat, mixed gas tanks, recompression chambers and the like. Wiebe, a veteran diver with 17 years experience in the Navy, is chief of the crew. Other members, hand-picked by Wiebe, are Billy Ray Wilson, COP, Patrick Bowman, CPO, Peter Schwartz, petty officer first class, and Arthur Allen, petty officer second class.

Selected for their mechanical ability to use special tools to erect or dismantle underwater structures or equipment, the men will work at the Marshall center's facility which simulates the weightlessness of space.

Working underwater, in full-scale segments of the Space Shuttle and Spacelab, the crew will assist test engineers with contingency procedures, operation of equipment, evaluation of space construction techniques and other activities to be carried out on Space Shuttle and Spacelab missions.

For each underwater test using a space-suited person, two Navy divers are assigned responsibility for the subject's safety. Others are assigned the tasks of preparing hardware and making sure that necessary tools are in place before beginning the test. During the tests, the divers remain nearby to retrieve tools that might be dropped or to reinstall hardware in repeated testings. Between tests, the divers dismantle, remove or rearrange hardware underwater or install new test hardware.

Wiebe said, "We were all pleased that we were asked to come here and be a part of the Space Shuttle program. It is an interesting, challenging and exciting type of work."

Navy Divers at Marshall—The five U.S. Navy divers assigned to NASA's Marshall Space Flight Center to support testing in simulated weightlessness for the Space Shuttle program are shown in the neutral buoyancy simulator. They are (left to right) CPO Patrick Bowan; CPO Richard Weibe a master diver and leader of the crew; CPO Billy Ray Wilson; Arthur Allen, petty officer second class; and Peter Schwartz, petty officer first class. All five were fleet salvage divers for the Navy. Their NASA assignment is expected to last three to five years.

NASA Launches Satellite for Worldwide Weather Study

The European Space Agency's Meteosat was launched Nov. 22 from Cape Canaveral, by NASA's Delta 2914 rocket. The weather satellite becomes a part of a worldwide meteorological program employing as many as five geostationary satellites. The satellite's Earth synchronous orbital position is at zero latitude and longitude placing it over the western coast of Africa.

Launch was delayed twice when mysterious radio signals repeatedly were heard that were identical to command signals given to destroy rockets headed off course towards the Florida coast. Investigations revealed that the signals were coming from the Redstone, a tracking ship in Port Canaveral.

John F. Yardley, associate administrator for space flight, explained that "Apparently technicians were testing some radios that give out the same kind of command and destroy signals for missiles that we use for rockets."

Meteosat is one of the first practical applications of European space research and technology. Eight of ESA's 10 member countries are participating: Belgium, Denmark, France, Germany, Italy, Sweden, Switzerland and the United Kingdom.

The five spacecraft that make up the worldwide program will be placed at equal distances around the globe and will transmit cloud cover images to ground stations for processing and relay to users. Meteorological data collected from platforms, buoys and low polar orbiting satellites also will be collected. This system will be an important element of the Global Weather Experiment, a part of the Global Atmospheric Research Program.

Additionally, the U.S. and the Soviet Union plan to launch two satellites, each into polar orbit. The mission of these satellites is to:

- collect and disseminate observation data on cloud formations and Earth surface temperatures,
- collect and disseminate meteorological observations data from ships, buoys and unmanned observatories,
- observe solar protons by space environment monitor.

In addition to those countries participating in the satellite portion of the weather experiment, approximately 145 countries also will make contributions to the worldwide weather effort by taking daily surface and atmospheric measurements in their respective areas. All such data will be sent to

central data centers in Moscow and Washington, D.C. Current planning calls for the program to be ready for the first intensive observation period by December 1978.

The global system of precisely placed satellites in geostationary orbit will extend the presently limited amount of meteorological data European scientists receive from U.S. spacecraft designed to provide information for one or two day forecasts of weather conditions in the United States. Since climatic conditions in one part of the world can affect the weather many thousands of kilometers away, the continuous observation of all the Earth's surface and cloud cover by the global system will produce for Europe, or any other region, accurate weather forecasts for more than only a few days.

The potential value of advanced, accurate weather forecasts to agriculture, forestry, fishing, transportation, tourist and construction industries is tremendous.

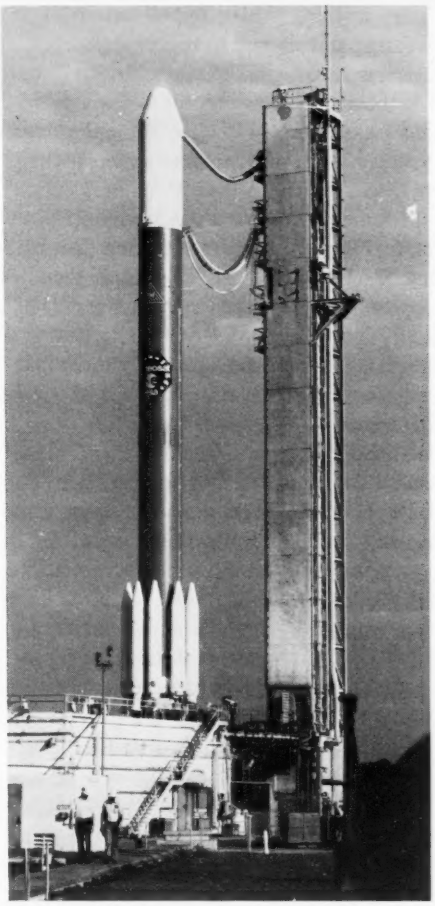
Severe storm warnings or other weather extremes, as well as favorable forecasts for leisure and work, can affect the lives of people thoughout the world.

Meteosat observes the Earth and its cloud cover in both the visible light and infrared regions. A high resolution radiometer achieves a definition of 2.5 kilometers on the ground in daylight, 5 km in the infrared. Images are composed of 2,500 lines in the infrared, 5,000 lines in the visible light channel. A line-by-line scan picture is taken every 30 minutes. Line scanning is achieved by the satellite's rotation at approximately 100 rpm. Line-to-line shifting is obtained by tipping the telescope.

Unprocessed images received directly from Meteosat are of sufficient quality to be of immediate use. For more precise definition compatible with international Automatic Picture Transmission (APT) and Weather Facsimile (WEFAX) standards, the raw picture is processed by computer on the ground and sent back to the satellite for retransmission to weather stations. WEFAX transmissions can be sent for the complete coverage with lower resolution, or with high resolution for a limited zone. Two transmission channels are devoted to WEFAX.

Images will be used in a variety of ways. Infrared images will help determine Earth surface and cloud temperatures with a precision of one degree. Cloud height can be deduced from these temperatures. Wind velocity, especially in the tropics, may be determined with three meters-per-second precision from the observed movement of small clouds.

Data will be collected from the interrogation of Earth stations, buoys at sea and weather balloons. Meteosat has a data retransmission capability. It will send to processing sites data collected by satellites in low polar orbit such as those taking vertical soundings of atmospheric temperatures obtained by a multispectral infrared radiometer.



Meteosat Ready to Go—Delta launch vehicle 136 at the ready for launch of ESA's newest weather satellite at Cape Kennedy. Meteosat is a link in a globe-girdling weather watch system.

The system's flexibility makes data acquired by Meteosat available through its sister spacecraft in the global network to meteorologists, oceanographers, hydrologists and other Earth scientists, thus improving weather forecasting.

Although Meteosat's most obvious, even spectacular, potential is that of saving human lives and limiting property damage by early warning of hurricanes or severe storms, its contributions will also

be felt in agriculture, fishing and all industries on which weather and climate have a bearing.

Meteosat is 2.10 meters in diameter, 3.195 m high excluding the apogee boost motor and weighs 697 kilograms including the 345 kg ABM and fittings.

Data Acquisition, Telecommand and Tracking Station (DATTS) will be the telecommunication terminal for the main S-band up/down links with the satellite. Located at Odenwald (near Darmstadt) Germany, DATTS will be linked to three facilities of the European Space Operations Center at Darmstadt. These are:

- Meteosat Operations Control Center which controls the entire system and coordination of operations;
- Data Referencing and Conditioning Center, for general data handling and processing;
- Meteorological Information Extraction Center for reception and display of full resolution digital pictures or WEFAX data.

NASA's Space Tracking and Data Network (STDN) has full telemetry and command support responsibility for the Meteosat mission from pre-launch activities through a portion of the drift-orbit phase, until the spacecraft comes into view of the dedicated ESA ground station.

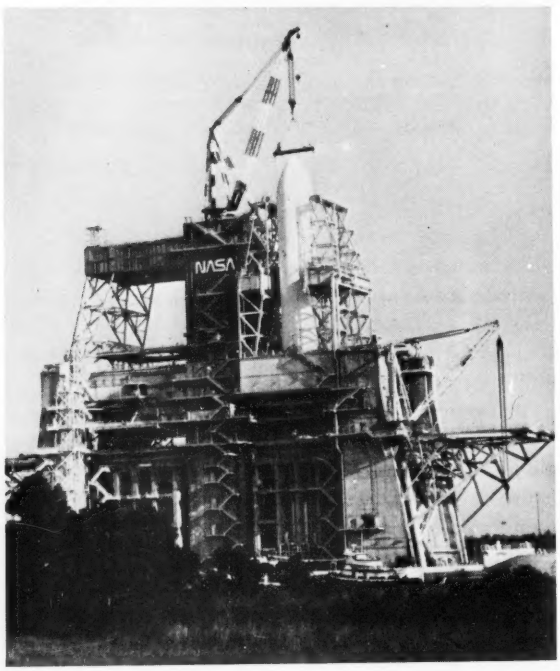
At that time, ESA assumes full mission responsibility and NASA STDN support terminates. The Ascension Island STDN will, however, provide emergency backup command support.

STDN station activities are coordinated between Goddard's Network Operations Control Center, and ESOC Darmstadt, in accordance with previously established NASA and ESA agreements.

The prime STDN Meteosat support stations are at Orroral Valley, Australia, and Guam (Pacific) for the first apogee and all subsequent odd-numbered apogees. Santiago, Chile, and Rosman, N.C., are the prime sites for the second apogee and all subsequent even-numbered apogees.

During the 24-hour period following the apogee motor firing, continuous tracking was provided by the in-view STDN sites. Continuous telemetry and command support from one station was provided from apogee motor firing plus three hours until acquisition by an ESA ground station. Support thereafter is limited to occasional coverage by one station (on demand).

The Cannes Establishment of Aerospatiale is prime contractor for the development of Meteosat, heading the Cosmos Consortium which includes organizations from France, Spain, Belgium, Germany, the United Kingdom and Italy. Additionally, the Cannes Establishment of Aerospatiale is responsible for project management, systems studies, integration and testing.



External Tank in Place, Awaiting Orbiter—The Space Shuttle's external tank, largest element of the Shuttle, is installed in a giant test stand at NASA's National Space Technology Laboratories, where it will be used in main propulsion tests of the Shuttle's cluster of three main engines. For the tests, which are managed by Marshall center personnel, the tank will be mated to an orbiter simulator and full-sized orbiter aft section containing the three engines. The external tank, 47 meters long and 8.4m in diameter, will feed propellants to the main engines during the tests and later during actual Shuttle missions. The engines will burn for about eight minutes during a typical Shuttle mission. The main propulsion tests will be conducted by the Rockwell International Space Division.

Space Technology to Improve Coal Mining

It's a long way from coal mines under the Earth's surface to the surface of the Moon, but technology that allowed men to explore the Moon may help solve the nation's energy shortage by making coal mining safe, more productive and more economical.

Using technology developed for the lunar roving vehicle so successfully used on the Moon, an automated guidance and control system is being applied to a coal mining machine by engineers at the Marshall Space Flight Center in a project for the Department of the Interior's Bureau of Mines.

The "longwall machine," now operated by miners, is a large shearing machine that grinds coal from a wall or face of a coal seam in a more or less straight line, sending coal out on a conveyor, and advancing, together with its mechanized roof supports, as it travels deeper into the seam. Automating this machine would create enormous advantages, and would eliminate the need for a human to work next to the cutting operation, often an unhealthy and unsafe environment.

At present, longwall machine operators frequently do not mine coal to the extreme edge of the seam at the roof or floor for fear of breaking into surrounding rock or shale.

The new automated guidance and control system would allow the machine to remove virtually all the coal present at a much faster cutting rate, thus increasing the annual production by millions of tons and recovering more of the coal now left in the ground.

The coal taken also would be purer, and guidance and control system would reduce wear on the longwall machine's cutters and minimize downtime on the machine.

The Marshall center recently issued a request for proposals to industry for an "Automated Longwall Guidance and Control System Study." The successful contractor will produce sufficient data to define a prototype system. From this prototype, final hardware design and fabrication can be initiated.

As a basis for his study, the contractor will use the results of preliminary studies made by Marshall center engineers over the past two years. These studies have indicated the potential practicality of a system using sensors such as gamma rays, radar beams, impact devices and reflected light to guide the longwall shear's cutting drums.

Participants Chosen for Space Telescope Project

Eighteen scientists have been tentatively selected by NASA to participate in the design and early operational phases of its space telescope project. The 10-ton observatory, to be launched into Earth orbit in 1983 by the Space Shuttle, will make astronomical observations deeper into space and in more detail than ever before. It should provide solutions to some of the mysteries related to the structure, origin, evolution and energy processes of the universe—solutions that could never be reached by observatories below the obscuring veil of Earth's atmosphere.

The space telescope should permit astronomers to observe some 350 times the volume of space that can be seen now with the largest ground-based telescope.

Once placed on orbit, the telescope will be operated by remote control from the ground, but it will be designed so that a space-suited astronaut can maintain the device and change its instruments if need be. It also will be retrievable by the Space Shuttle for return to Earth for extensive overhaul and subsequent relaunch. These features should allow the Space Telescope to serve as an in-space astronomical observatory for more than a decade.

The 2.4-meter space telescope will be capable of accommodating five different instruments at its focal plane. The observatory will weigh 9,100 kilograms and will orbit the Earth at an altitude of about 500 kilometers above Earth's atmosphere.

Scientists have been chosen to head teams to participate individually in a variety of categories such as:

Investigations Definition Teams: These teams consist of principal investigators, co-investigators and supporting staffs who will design and develop the focal plane scientific instruments. They also will carry out major scientific investigations.

Individual Co-Investigators: These are scientists who had not been affiliated with an investigation definition team before selection but who are now assigned to a team.

Astrometry Science Team: This team will be responsible for assuring that the fine guidance system will adequately perform astrometric functions as required.

U.S. Members of European Space Agency Faint Object Camera Instrument Science Team: The two U.S. members chosen represent the American astronomical community.

Telescope Scientists: Two scientists have been chosen with strong backgrounds in optical instrumentation. They will be responsible for interpreting the scientific performance requirements in terms of telescope design specifications.

Data and Operations Team Leader: Will lead a team of representatives appointed by each principal investigator to review or establish requirements and specifications for instrument control sytem, flight operation and ground data handling systems.

Interdisciplinary Scientists: Designed to give breadth to the guidance of the space telescope project beyond the concerns of the individual principal investigators and the technical specialists. The four chosen will be responsible for a broad scientific overview of the observatory's development.

Investigators selected by NASA, their respective institutions and subjects are:

The planned payload is composed of two cameras, two spectrometers and a photometer. The faint object camera, provided by the ESA and the wide field camera are distinguished by their fields of view, spatial resolution and wavelength range. Both instruments cover the ultraviolet and blue regions of the spectrum. The wide field camera covers the red and near-infrared regions as well. The faint object camera has a very small field of view but can use the highest spatial resolution the Space Telescope optics can deliver. The wide field camera covers a field at least 40 times larger but with a resolution degraded by a factor of two to four.

The two spectrographs provide a wide range of resolutions which would be impossible to cover in a single instrument. Only the faint object spectrograph covers the visible and red regions of the spectrum.

Principal Investigators	Institution	Area or Team
Dr. James Westphal	Calif. Institute of Technology	Wide field camera team
Dr. Richard Harms	University of Calif., San Diego	Faint object spectroscope team leader
Dr. John Brandt	Goddard Space Flight Center	High resolution spectroscopy team leader
Dr. Robert Bless	University of Wisconsin	High-speed photometry team leader
Dr. William H. Jeffreys	University of Texas at Austin	Astrometry team leader
Dr. James L. Elliot	Cornell University	Individual co-investigator on photometry
Dr. Bruce Margon	University of Calif., Los Angeles	Individual co-investigator on faint object spectrograph team
Dr. Arthur F. Davidson	Johns Hopkins	Individual co-investigator on faint object spectrograph team
Dr. P. Kenneth Seidelmann	U.S. Naval observatory	Individual co-investigator on wide field camera team
Dr. Daniel J. Schroeder	Beloit College	Telescope scientist
Dr. William G. Fastie	Johns Hopkins University	Telescope scientist
Dr. Edward J. Groth	Princeton University	Data operations team leader
Dr. Philippe Crane	European Southern Observatory	U.S. member/FOC team
Dr. Ivan R. King	University of Calif., Berkeley	U.S. member/FOC team
Dr. John N. Bahcall	Institute for Advanced Study	Interdisciplinary scientist
Dr. John Caldwell	State University of New York at Stony Brook	Interdisciplinary scientist
Dr. Malcolm Longair	Cambridge University	Interdisciplinary scientist
Dr. David L. Lambert	University of Texas	Interdisciplinary scientist

The fifth instrument is a simple, single-channel photometer that can be used both for calibrating the other intrument and for very high speed photometry. By operating while other instruments are observing, this instrument also can collect generally useful information on the brightness of the galactic background.

A Space Telescope science working group has been formed to provide scientific guidance to the project. The group is composed of the various team leaders, the two telescope scientists, the interdisciplinary scientists and appropriate project personnel.

NASA's Marshall Space Flight Center will have management responsibility for the Space Telescope. NASA's Goddard Space Flight Center will be responsible for managing the development of the scientific instruments and the operational aspects of the observatory. The European effort will be managed by the Netherlands.

New Appointee to New NASA Job

Raymond A. Kline was appointed to the new post of Associate Administrator for Management Operations Nov. 20, 1977. In his new position, Kline will be responsible for providing an integrated focus for institutional management and for the management of institutional resources in support of NASA programs.

Kline has served as Acting Associate Administrator for Center Operations from July 1977 until that position was abolished in the recent reorganization of NASA headquarters. Kline joined headquarters in 1968, after six years on the executive staff of Dr. Wernher von Braun at NASA's Marshall Space Flight Center.

Among his previous headquarters assignments were: Assistant Administrator for Institutional Management; Assistant Associate Administrator for Center Operations (Systems Management); and Assistant Associate Administrator for Organization and Management.

A native of New Ringgold, Pa., Kline received an A.B. degree in political science from Lebanon Valley College in Pennsylvania; an LL.B degree in law from George Washington University, Washington, D.C.; and did graduate work in public administration at that school. He is a member of the District of Columbia Bar.

During World War II and the Korean War, he served in the Army and before joining Dr. von Braun's staff, he held various management positions with the Army Missile Command, Huntsville, Ala.

NASA Receives Unusual Donations

Fredrik V. Olsen of Eureka Springs, Ark., recently deceased, willed $12,271.64 to NASA. His will contained no remarks about the bequest and inquiries have revealed no connection with the space agency. There are no living relatives to explain Mr. Olsen's interest in NASA. The American Red Cross also was named a beneficiary, but its share of the Olsen estate was mostly in the form of real estate. The money, in the form of U.S. Government bonds, was deposited as an unconditional gift to NASA and can be used in any NASA project.

The second donation was a check for $21.23 given for Space Shuttle expenses by the fifth grade students of the Lake Arrowhead (Calif.) Elementary School. The children had heard about "cost overruns" in the Shuttle program and responded by taking up a collection which was sent to the Rockwell International Corp., builder of the Shuttle. Rockwell returned the money to the youngsters with expressions of thanks and souvenir pictures and informational material.

Vanguard Anniversary to Be Observed

Not too many people outside NASA remember the name of the *second* person on the Moon any more than they remember the name of the *second* U.S. satellite, Vanguard. But a few hundred veterans of the Project Vanguard team remember the satellite very well and will gather on March 17, 1978 to celebrate the 20th anniversary of the launch of Vanguard 1.

Dinner parties will be held simultaneously in Washington, D.C. and Cocoa Beach. Notices will be sent to all who were part of the project on or before March 17, 1958—people in government, contractors, university members, and reporters and commentators. Persons who qualify and want to receive additional details are invited to call Al Nagy at headquarters (202-755-3936) or Bob Gray at the Kennedy Space Center (305-867-2234), or address their inquiries to Vanguard Anniversary, P.O. Box 862, North College Park, Md. 20740.

A New World Discovered

*Editor's Note: By this time, many people are familiar with the story of six-year-old David (last name withheld), an immunity deficient child, who has, since shortly after birth, been isolated within a protective plastic bubble. David, the victim of a rare immunological disease, lacks the natural defenses that protect most people from all sorts of infections, and, until last November, his only interaction with his family and others was through gloves extending into his bubble. But on Nov. 3, he was at last able to venture into the outside world inside a specially designed "space suit." (*NASA Activities *of November 1976 described the experimental garment on page 28.) The following behind-the-scenes story of NASA's participation in the development of the "miracle" suit is reprinted by courtesy of the Johnson Space Center's publication,* Roundup.

We talk a lot about using space technology for the benefit of mankind. We discuss spinoffs, future possibilities and new frontiers to explore. Many of these efforts succeed without even our own employees being aware of them, but a long and complex experiment at NASA's JSC is an example of the real thing: the dedication, the teamwork, the coordinating effort, the technical problems. Most significant, though, is the fact that the multiexpertise —the motley of specialized skills and technical knowledge available throughout the NASA center— were drawn together to turn a mere concept into a workable reality.

How many people were involved in the project of creating the mobile biological isolation system for the little boy affectionately known to the world only as "David, the bubble baby"? When one considers the uniqueness of the child and the project, it becomes clear that the entire operation had to be handled with the innumerable quality checks of a piece of flight equipment. There could be no margin for error.

If you buy a shirt at a store and a seam is sewn wrong, it is hardly a matter of life or death. But the central question in perfecting the isolation system was one of survival and, from that standpoint, a great many people had to be involved. These included: a project coordinator to locate the elements of expertise and keep open the lines of communication; an aid to the coordinator to handle some of the paperwork, and legalities; work with the people from the Texas Children's Hospital, and help write program requirements; a crew systems engineer to come up with the design of components for the suit and the transporter and to see that this design was comfortable as well as functional; a microbiologist to solve such problems as entry and exit from a sterile environment; manufacturers to build the suit and construct the components; quality assurance, operations, and safety personnel to look over everybody's shoulder and make sure specifications were followed and, mainly, that the specifications were correct; documentation personnel to write up every step of the project; quality control and reliability personnel to check and double-check every piece of equipment; and, of course, the hospital nurses and doctors who best understood David's delicate condition and who had to be trained in the use of the garment as well as set up the constraints in its construction.

Who were some of these dedicated individuals, many of whom gave much of their personal time to the project, and what specific problems did they encounter in their various fields?

Fred Spross was a member of the biomedical applications team of the life sciences directorate at the time of the initial receipt of a letter from the Baylor College of Medicine. The boy was then two-and-a-half years old. Dr. Sue Criswell, then with the life sciences directorate, happened also to be with the Baylor College of Medicine. She therefore became the major point of contact btween the two groups and remained on the MBIS project about halfway through, mostly because of direct interest in the project.

Spross was project engineer on the Apollo biological isolation garment, which works on a somewhat different principle than the MBIS planned for David. Since he was already familiar with spacesuits and with biological isolation garments from his experience, Spross said he "just happened to be in the right place at the right time" to merge the two concepts into a project like this. He became the project coordinator.

The first thing to be done was to outline a program, and Bill Carmean, a Martin Marietta Corp. contractor, helped Spross. Together they got people from the Baylor College of Medicine and wrote up requirements for the suit. Then they canvassed the Johnson center to find the expertise needed to build the system.

Naturally, everyone's space-related duties came before applications projects, so the work was accomplished on a noninterference basis. Another problem was administration, working out the legal and cooperative agreements with Baylor College of Medicine and the Texas Children's Hospital. Even within the hospital, each item had to be defined as either test hardware or medical equipment to

A First Embrace—David's mother was never able to hold her little boy in her arms until his multiple-layered "space suit"' was perfected. "He was very apprehensive the first time he got into the suit," said Dr. Murdina Desmond, head of the Baylor College of Medicine pediatrics team, but finally David said "Let's go for a walk," and a new life experience began.

First Trip from Isolation Bubble—"It took him a long time to crawl down the tunnel connecting the suit to his isolator," said nurse Brynn Holcombe. But then David smiled, shouted "I like it," and, once released, played with toys, hugged his family and toured the Baylor facility. "Neat-o," he reportedly said after his new experiences.

determine who could operate it. "Medical equipment" could be used by nurses and other hospital personnel. The hospital had its review cycles and so did NASA.

Rick Sauter in the engineering division did much of the work on the basic transporter design. He worked through Paul Ferguson, an expert in the manufacture of some of the unit components. Paul Ferguson was charged with the task of environmental quality inside the suit as well as life support. The suit for David is not a spacesuit for astronauts in which the person inside can be just as contaminated as he would be outside. A regular spacesuit, explains microbiologist Dick Graves, is a pressurized garment to keep an atmosphere inside a life support system. In David's case, however, there was the problem of oxygen content versus carbon dioxide buildup; there had to be a fail-safe washout system so the patient would not become oxygen depleted. Ferguson, using his flight engineering experience, helped build up what is known as differential pressure and the electrical and mechanical system to make David comfortable and also meet the requirements for the suit.

Bobby Miller and Bob Steele handled a considerable portion of the quality assurance and evaluation during the early stages of this development.

After a lag over legal agreements that lasted more than a year, Spross had joined another project that took most of his time. That's when Gary Primeaux took over the duties of Spross, and with the help of Bill Carmean, they went back to the hospital for an update. How many suits were needed? Were the

requirements for the suit still valid? Could they arrange some kind of target date and schedule? When would some training for the parents and nurses take place? There were a few minor improvements and additions from various sources. There had been some "open" items, unresolved issues. And David had grown.

The system was then presented as it was with the proposed changes and modifications added—but only minor changes. Building of the delivery items began.

The helmet was found to be the only major design change required. There were ruptures in the seam areas. The new helmet is much superior to the first version, with the inlet air duct the main difference. A protective sheet also was added over the hose, and there were improvements in the ring areas, where the O-rings are sealed into the ring interface at the end of the exit tunnel.

Graves pointed out that coming from a sterile environment and going into a sterile environment was his main challenge as a microbiologist. Once the MBIS with the child inside has been taken into the unsterile outside world, how do you get him out of the suit and back into his sterile living quarters without contaminating him or the inside of the suit? You can't bring him *and* the suit back into the sterile living area.

So the researchers decided not to try to keep the outside of the suit sterile. A connection through a tunnel and an adapter ring would serve the purpose much better. It only remained for Graves to work out a method of sterilizing the connecting surfaces so that when the connection was opened up and David crawled back through the little tunnel, he would not bring any contaminants with him.

A considerable amount of testing and checking was done before delivery of the suit. Several children of JSC people who worked on the project became test subjects. The group even took the children down to a park and played games using the transporter.

In late July, David had his special suit which ended, at least partially, his six years of isolation. The suit will soon be tested at the Los Angeles Children's Hospital, where young leukemia patients, made immune-deficient because of chemotherapy treatment, may also derive benefits from David's suit or a modification of it.

Small but Wonderful—Such an ordinary thing as running water becomes an object of incredible fascination for little David as he views a faucet for the first time.

Special Runabout—An equipment pushcart, built from a lawnmower chassis, carries the power air system used in the "space suit" and has a seat on which David can ride. His sister, Katherine (at right) considers herself the official cart pusher, and is probably helping him the most to adjust to riding in it. His mother stands with David. Eye distortion is because of bubble's plastic effect.

Federal Women's Program Sponsors Lively Session

The NASA headquarters FWP committee held its annual FWP session recently. An interesting and pertinent program for all headquarters employees was developed by committee members.

The committee sponsored a luncheon on Capitol Hill on Nov. 9. Two women in influential positions, one in Senator Harrison H. Schmitt's office and the other in the Congressional Budget Office spoke. Ruth Bates Harris, former NASA Deputy Assistant Administrator for Community and Human Relations, also spoke.

Harris shared her views on "Communication for Advancement." She encouraged employees to take responsibility far beyond their job descriptions. For example, a secretary might take incoming correspondence and acknowledge it or answer telephone inquiries without disturbing the supervisor. To do this, an employee must take initiative and learn as much as possible about the office and its work. "Show that you have the potential for moving ahead," she said.

Diana Griffin, a former Johnson Space Center employee, became Sen. Schmitt's campaign manager in New Mexico and is now his Administrative Assistant. In discussing "The Expanding Role of Women in Politics," she noted that it is unusual for a woman to hold such a job in a Senator's office, but that the current trend on Capitol Hill is to hire more women in professional positions. Her advice to women is to be willing to try anything, and "You'll be amazed at what you can do." She mentioned that lobbying is an effective tool on Capitol Hill, and she is happy to see women using that tool.

The subject of Dr. June O'Neill's talk was "Women in the Budget Process." She is chief of the human resources cost estimate unit of the Congressional Budget Office. She explained the functions of the Congressional Budget Office, and said that women are beginning to have an effect on the budget process. Close to 34 percent of the professional staff of the office are women and about 28 percent of the combined professional staffs of the Senate and House Budget Committees are women.

On Nov. 10, the Hon. Alan K. Campbell, Chairman, Civil Service Commission spoke. He was introduced by Robert A. Frosch after Dr. Harriett Jenkins opened the program. Campbell discussed

Attendees (l. to r.) Dr. June O'Neill, Ruth Bates Harris, and Diana Griffin

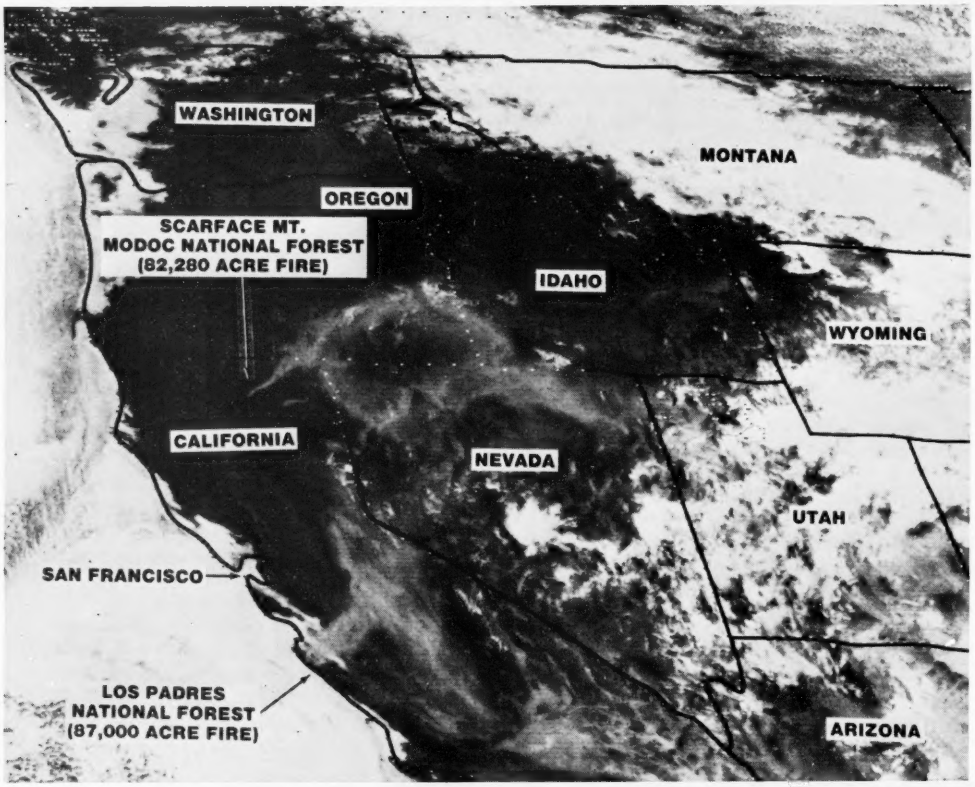
"Personnel Reorganization as it Impacts on Women and Minorities." He reiterated his support of Equal Employment Opportunity programs and explained that problems of minorities and women will be given emphasis now, just as other groups, for instance veterans, have had special attention in the past. Meeting qualifications for a job will continue to be of utmost importance. Campbell stressed that the emphasis on women and minorities will not be at the expense of a competent workforce.

On Nov. 12, Christine Smith, a participant in NASA's Ames Research Center's bed rest program, was warmly introduced by Dr. Rufus R. Hessberg,

The Hon. Alan K. Campbell addresses the meeting.

director of space medicine. Smith graphically described her experiences in the program by sharing slides of the women's participation in the program. She explained that as a housewife she came to the point where she needed something additional in her life. She described her feelings when she saw the small NASA ad in the society section of the newspaper, which asked for women volunteers to participate in tests related to Space Shuttle flights and her hope that she would be selected as one of the participants. The program, even though it involved hard work, included meeting new people and experiencing new life adventures. One of the findings, she said, was that women can handle the physiological problems as well as men, and the psychological aspects of the testing better. As a result, of the experience, she said, her life has become more meaningful. She is currently applying for a nursing job at Ames to work in a new bed rest study.

Speaker Christine Smith



Forests Afire as seen from Spacecraft—A photo of the western United States taken by the Synchronous Meteorological Satellite-2 in August shows heavy smoke plumes rising from California's Los Padres and Modoc national forests. The two SMS spacecraft in orbit are operated by the National Oceanic and Atmospheric Administration after development and launch by NASA. Data for this photo was received by NOAA's Wallop's Island (Va.) station and computer processed at the agency's National Environmental Satellite Service.

Navy Satellite Launched

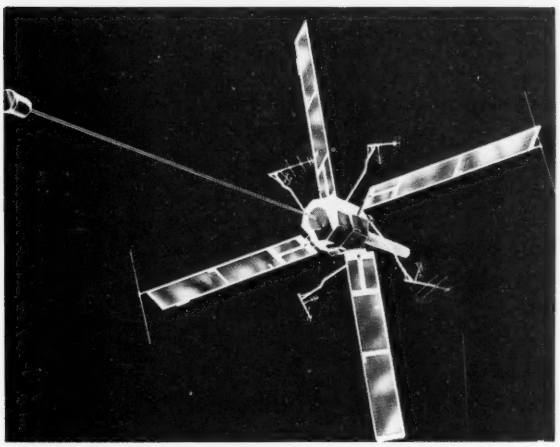
The Navy Transat satellite was launched on a Scout launch vehicle from NASA's Western Test Range Oct. 27. The satellite is a modified Transat navigation spacecraft, the sixth in a series.

Under a NASA/DOD agreement of June 1962, establishing the basis for joint use of the Scout launch vehicle, DOD/Navy has called upon NASA to provide Scout launches for the Navy Transat and Transat improvement programs. Fifteen Transat satellites and three Transat improvement program satellites have been launched to date. The Navy reimburses NASA for the cost of Scout launch vehicles, WTR launch services and mission support requirements, and supporting services as required.

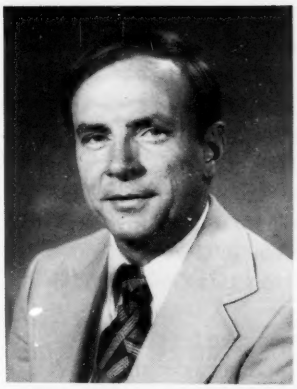
The Transat program is an operational navigation system used by the U.S. Navy and other vessels for worldwide ocean navigation. Currently there are five operating satellites in the system. Two Scout vehicles are maintained on standby status to launch replacement satellites to fill any operational gaps that might occur in the system.

NASA's WTR, the launch contractor (Vought Systems Division, LTV Aerospace Corp.), the Air Force and NASA supplied personnel and equipment required to perform the assembly of the Scout launch vehicle, the prelaunch checkout and the launch.

The DOD tracking network provided tracking support to establish the orbit achieved; NASA provided command support on a backup and emergency basis.



Navy Spacecraft—An artist's version of the Navy Transat satellite recently launched under a NASA/DOD agreement. The spacecraft weights 93 kilograms; it is used for worldwide navigational operations.



Lewis Engineer Wins ASME Best Technical Paper Award—For the second consecutive year, Dr. Bernard J. Hamrock, an engineer at NASA's Lewis Research Center, has won the American Society of Mechanical Engineer's award for best technical paper. Hamrock co-authored the paper with Prof. Duncan Dawson of Leeds University, Great Britain, on the subject of isothermic lubrication of point contacts. He is with the mechanical components branch of the Lewis Center's fluid system components division. It marks the first time in ASME history that the same authors have won the top award in two successive years.

Minority Institutions Receive NASA Grants

The Marshall Space Flight Center earmarked $530,000 during FY-77 for 21 grants to 12 minority educational institutions in six states. The work includes new projects as well as projects already in progress.

Six grants totaling $159,994 went to Alabama A&M University in Huntsville, and Tuskegee Institute received grants of $25,000 and $23,349. Two Mississippi universities, Alcorn State and Jackson State, received grants of $22,132 and $26,788 respectively.

In Georgia, Atlanta University received three grants totaling $78,319, Morris Brown College three grants totaling $79,616, and Savannah State College $15,569.

Grants of $33,973 and $28,700, went to Fisk University in Nashville, Tenn., and North Carolina A&T State University in Greensboro, N.C., received $23,155.

In Louisiana, Southern University at Baton Rouge received a $24,500 grant and Xavier University in New Orleans a $21,560 grant.

Research being performed under each of the Marshall center grants is directly connected with continuing programs and projects at the NASA center.

First Woman, First Black Named General Counsel

Allie B. Patimer, with nearly 20 years of service at GSA as an attorney, and most recently a NASA employee, has returned to GSA as general counsel. She has made history on four fronts: first woman to serve GSA as general counsel; first black to serve GSA as general counsel; first woman in GSA to attain GS-18 level, and first black to attain GS-18 level in GSA.

"Allie Latimer is highly qualified for this position by her experience and her training," GSA administrator Jay Solomon said when he administered the oath of office. "She will be a key member of our management team."

Latimer was an assistant general counsel for general law at NASA from December 1976 to November 1977. Previously she was an assistant general counsel at GSA for its automated data and telecommunications service. Her new responsibilities will include directing a staff of more than 100 lawyers and she will serve as the principal legal advisor to the Administrator and other GSA officials.

An Impressive "First" Is Sworn In—GSA Administrator Jay Solomon swears in new general counsel Allie B. Latimer as her mother, Mrs. Bennie C. Lee (of Charlotte, N.C.) holds Bible.

Latimer has a bachelor degree from Hampton Institute (Va.), a J.D. from Howard University, an LL.M. from Catholic University, and has done additional graduate study at American University. All three are in D.C. She is a member of the American, Federal, North Carolina, District of Columbia, Washington and National bar associations and the World Peace through Law organization. She was secretary of the National Bar Association for nine years and later president of NBA.

"New" Aircraft Arrives at Wallops—Shown in picture above is the NASA 428 arriving at the Wallops Flight Center airport from the Johnson Space Center. This turbine-powered P-3 aircraft, formerly in the JSC Earth Suvey Fleet, is scheduled to replace one of the WFC C-54's. It was a sentimental journey for the aircraft commander, Joseph Algranti, who had picked up the airplane from Pax River about 10 years ago to deliver it to JSC. On this most recent trip, he was back on the East coast delivering the same plane to WFC. The newly acquired aircraft will be instrumented with an impact area surveillance radar and remote sensing equipment. Flight and maintenance personnel have begun crew training and checkout. Refurbishing may take about six months. Compared to the "old" C-54, the P-3 burns JP-4 instead of high octane gas, cruises at about 180m/s instead of 82-87m/s, and is pressurized to operate at higher altitudes. The P-3 should be another valuable asset for support of the Wallops launch range and the many continuing projects in aeronautical programs.

Did You Know?

A statement in the October *Activities* contained in the article "Russian Biology Satellite Carries U.S. Experiments," (in the last sentence: "The last U.S. biological research spacecraft launch was Biosatellite 3 in 1969"), was corrected by Laurence C. Rossi, OFO-A project manager at the Wallops center. Rossi points out that the "Orbiting Frog Otolith Project" took place in November 1970, and that it was the forerunner to NASA's vestibular function research program. The experiment placed two bullfrogs into a weightless environment for several days in a small spacecraft launched by a standard four-stage Scout from the Wallops center. The period of revolution was about 92 minutes.

Dr. Bevan M. French, NASA's program chief of extraterrestrial materials research (Lunar and Planetary Programs, Office of Space Science) is the author of a new publication entitled "The Moon Book," described as a highly readable summary for the layman of what Man has learned by going to the Moon. Published by Penguin Books, N.Y., N.Y., the book sells for $4.95.

November 9 marked the 10th anniversary of the sucessful launch of first Saturn V rocket, after a three-day countdown, clearing the way for a series of flights of the world's largest space vehicle. Saturn V vehicles carried all the Apollo spacecraft on their history-making missions.

Almost half the Marshall center's employees can now work on the "flexitime" system if they wish. The 1,700 employees involved are non-supervisory scientists and engineers represented by the Marshall Engineers and Scientists Association, which recently negotiated the new system with NASA. Under the program, in effect in many government agencies throughout the country, an employee is free to propose to a supervisor an eight-hour work day that can begin from 7 a.m. to 9 a.m. or at any other 15-minute increment in between. Once approved, the employee observes the same schedule every day.

The squirrel monkey billed as "the first lady of space" when she made a journey atop a Jupiter ballistic missile May 28, 1959, as a precursor to manned space flight, is still alive. She was six months old at the time when she rode at an altitude of about 100 miles then splashed down into the Atlantic. She is now 20, and lives in a glass enclosure at the Alabama Space and Rocket Center. In human terms "Miss Baker" is about 75 to 80 years old. On the monkey's 20th birthday, last July, a party was held, attended by about 40 children. She received a cake and letters of congratulations from space program officials and some members of Congress.

Contractor News

The Klate Holt Co. of Hampton, Va., has been chosen for negotiation leading to award of a contract to provide facility and equipment maintenance support services to NASA's Langley center. The contract covers a period of three years beginning in March 1978; its value is estimated at about $13 million, with two one-year unpriced option periods.

The Martin Marietta Corp. of Denver has won a $1.735 million contract for conducting all analysis and design activities necessary to the support of a teleoperator retrieval system preliminary design review in early March 1978. NASA's Marshall center has been assigned management responsibility for development of the system.

The Mayfair Construction Co. of Chicago has been awarded an $800,000 contract to build utilities control systems for the Kennedy center's launch complex 39. Work includes revamping of various facilities to handle the Space Shuttle.

General Dynamics Corp., Convair Div., of San Diego, has signed a $31.5 million contract with NASA's Lewis center for management and engineering services needed to support the Lewis-managed Atlas/Centaur launch vehicle program. The cost-plus-award-fee contract will provide for services connected with NASA planetary and Earth orbital missions during the period Dec. 1, 1977 through Nov. 30, 1979.

Holloway Corp. of Titusville, Fla., has received a $1.61 million contract from NASA's Kennedy center to modify a building for processing of Space Shuttle parachutes. The firm will turn the old Gemini parachute facility (later used as a press center) into an area for processing parachutes to be used to return the Shuttle's solid rocket boosters to the surface of the Atlantic Ocean. Equipment for washing and drying the parachutes is part of the project.

General Electric Company's contract for aircraft engine maintenance, modification and repair at the Dryden center has been renewed. Estimated cost for the cost-plus-fixed-fee contract for the first year is expected to be $1.2 million.

The Rockwell International Space Division, Downey, Calif. has signed a supplemental agreement to the Shuttle orbiter contract with NASA's Johnson center, covering engineering changes. Valued at more than $2.5 million, the supplement brings the total estimated worth of the Rockwell orbiter contract to $3.2 billion.

The Frank Briscoe Co., Inc. of East Orange, N.J. has won a $5.75 million vehicle assembly building modification contract from the Kennedy center. To be completed in 10 months, the contract calls for Briscoe to revamp a section of the building for mating and checkout of Space Shuttle components, to install external-tank checkout cells in another section, and to modify cells for storage of the Space Shuttle main engine.

Tiny Transmission System Shows Dramatic Results

Two briefcase-sized transmitting stations linked with the Applications Technology Satellite-6 (operated by NASA's Goddard Space Flight Center) were used recently to demonstrate the feasibility of such a communications system for emergency medical services. ATS-6 is in synchronous orbit at a height of 36,000 kilometers over the equator south of Hawaii. Goddard is investigating such transmissions as part of a study of a proposed public service communications satellite.

Transmissions were made between Baltimore's University of Maryland Hospital and the Department of Transportation building in Washington, D.C., linking a subcommittee on communications of a federal interagency working group on emergency medicine to the Maryland Institute for Emergency Medical Services. The transceiver used weighs only 10 kilograms.

Dr. R. Adams Cowley, Director of MIEMS, spoke with representatives of the Department of Health, Education and Welfare, Department of Transportation, National Highway Safety Commission and other interagency working group members in Washington, telling them "I couldn't even think of all the things we could do with such a system as this. . . . It's astronomical . . ."

Cowley praised the compactness of the ground system which actually fits into a briefcase. He said: "What is of great value is the consultation we can do with such a system," adding that it could provide communications between a hospital and rescue crews and even transmit an injured person's vital signs to doctors miles away.

Howard Hupe, of HEW, said it would be especially useful in disaster situations. "Power systems and communications are the first thing to go in an emergency like a flood," he said. Dr. Cowley said that in preparing for major disasters or as a Civil Defense procedure, the briefcase units could be inexpensively placed in C.D. stations around the country.

Commenting on the small amount of power required to operate the device, Jim Brown of Goddard said a 20 amp battery runs a transmitter for "several hours of continuous transmissions." He added that it uses about 100 watts and runs very well hooked into a car's cigarette lighter. He said it cost about $5,000 to make the first briefcase unit at the Goddard center, the high cost simply because it was a new concept. If they were produced for use on a wide scale, for example, for use by police medical emergency services, Civil Defense, Forest Service rangers ,and others, the price would probably drop to about $1,000 to $1,500 apiece.

The key advantage to this type of transmission is that because of the great height at which ATS-6 orbits, the signals travel almost straight up and down, and weather and distance have little or no effect on receipt of the transmissions. Thus it is ideal for clear communications in almost any terrain—only a direct orbstruction between the satellite and the transmitter would make a difference.

Another demonstration of the mobile communications system was conducted in late November in the Dominican Republic, under the sponsorship of AID, as part of a large workshop on technology applications for Latin America. Among the 300 attendees was AID Director John J. Gilligan (former Governor of Ohio), the President of the Dominican Republic, H. Joaquim Balkuer, and officials of the World Bank and OAS. The demonstration involved health care teleconferencing between Santa Domingo and remote villages, using NASA-supplied L-band transceivers in attache case units, powered by Lewis Research Center photovoltaic cells.

AID funded the entire demonstration which was very well received.

Johnson Space Center Installs Shuttle Data Processing Complex

Installation of the third IBM System-370 model 168 computer for monitoring and controlling Space Shuttle flight has been completed and accepted by NASA at the Johnson Space Center. The three system/370's and associated communications equipment make up the Shuttle data processing complex, which supports the space agency's Mission Control Center.

Real-time Space Shuttle flight support will usually be provided by one System/370 model 168 designated the mission operational computer. During critical Shuttle flight periods, however, two computers will process identical data concurrently. The third computer will perform in a standby mode.

In an actual mission, the ground computers do Shuttle trajectory monitoring and evaluation, trajectory prediction and planning, orbiter systems performance monitoring and analysis, orbiter command computations and uplink, and other computations that supplement the data processing operations performed onboard the Shuttle Orbiter by IBM flight computers.

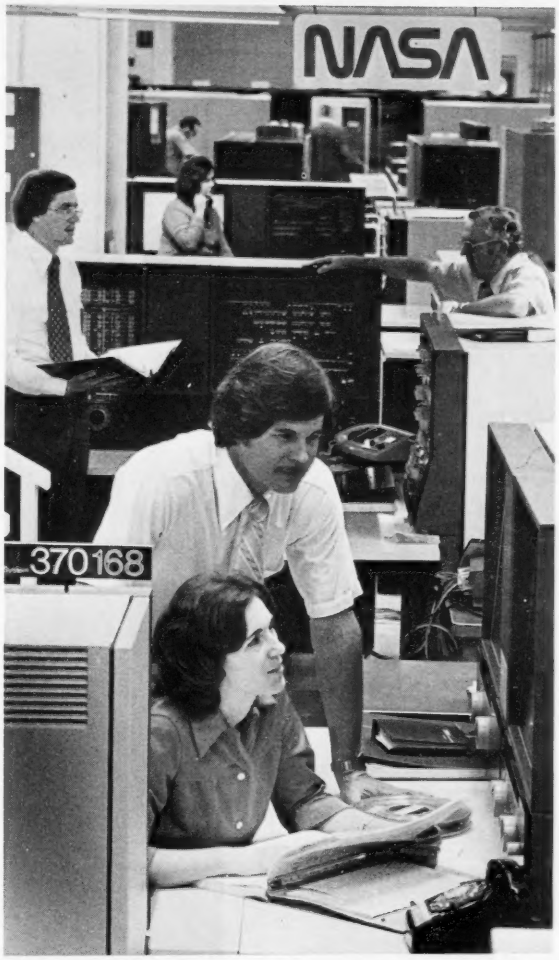
The computers also will support program development, payload data processing, flight controller training, and testing activities. Advances in basic circuits and processor architecture provide the computers with more than three times the power of the System/360 computers operated in the real-time computer complex during Apollo missions.

Each model 168 computer contains seven-million bytes of memory. The data channels which connect the computer with input/output devices are, in themselves, powerful processors for directing multiplexed transfers to many external devices. The external devices include digital displays, plot boards, indicator lights, push buttons, and interactive terminals.

For the most part, standard IBM system programs are used for control of the computers, input/output operations, and those tasks that must be performed regularly regardless of the data being handled and the processing desired. Minimal modifications have been made to allow them to interact with special real-time devices in the Mission Control Center.

IBM Federal Systems Division programmers in Houston are developing the application programs required for the System/370s to perform the computations that will help NASA flight controllers monitor and control each Shuttle mission. In addition to the programs required for operational mission support, others are being developed to aid in the checkout of new applications programs and to facilitate rapid reconfiguration of the operational Mission Control software and hardware between Shuttle missions.

In addition to providing computers and programming support for NASA's ground and in-flight monitoring of Space Shuttle missions, IBM also will support Shuttle launch processing operations at the Kennedy Space Center beginning in 1979 with the initial Shuttle orbital flight tests.



Shuttle Mission Control Computers—IBM programmers check out computer displays during installation of the third IBM System 370 Model 168 computer at NASA's Johnson center. The Shuttle data processing complex will provide all Shuttle information except voice exchanges to the flight controllers in NASA's Mission Control Center.

For Heaven's Sake, Watch the Birdie—This misguided killdeer saw fit to lay her eggs only inches from a heavily traveled roadway at the Johnson center. Conservation-minded Johnsonites, worried lest the four eggs be destroyed by traffic near the nest, manufactured a sign warning passersby of the nursery activities. The mother bird sat patiently on her eggs (see inset), becoming aroused only when photographers or shuttle bus passengers came too close to her brooding place.

Builds Own Solar Heater—O. L. Smith, an engineer at NASA's Marshall center, invested about $300 in materials and built a water heater that furnishes his home with lots of free hot water. The simple system has no controls, no pumps and uses no gas or electrical power. He used an 333-liter, unlined, uninsulated galvanized tank, placed it in a wood frame lined with reflective insulation at a 45-degree angle facing south, and covered it with two thin layers of .4-centimeter Plexiglas with one 2½ cm air space between. As cold water rises in the tank from the bottom, it is heated to about 52 degrees Celsius by the "greenhouse" effect of the Sun on the Plexiglas. Pressure from city water lines forces the heated water from the top of the tank into the home's existing electric water heater. The solar hot water system provides all of the home's needs during days with plenty of sunshine. "Anyone with a little mechanical aptitude and the ability to use a hammer, saw and wrench could easily put it together," Smith said.

Patents for Inventions from NASA Research

The Office of General Counsel, NASA Headquarters, announces that the following U.S. patents have been issued by the U.S. Patent Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel of the indicated installation.

Inventor(s) and Employer	Title & NASA Docket	Patent No.	Installation
Wilbur C. Vallotton, NASA/ARC	Mechanical energy storage device for hip disarticulation	4,051,558	ARC
Charles G. Miller, Jens G. Pohl, NASA/JPL, Pasadena, Calif.	Portable, linear-focused solar thermal energy collecting system	4,051,834	NRLO
Lee S. Terp, Garrett Corp., Los Angeles, Calif.	Gas compression apparatus	4,051,877	JSC
Cecil J. Marek, NASA/LERC	Fuel combustor	4,052,144	LERC
Taylor G. Wang, Daniel D. Elleman, NASA's JPL Pasadena, Calif.	Acoustic energy shaping	4,052,181	NRLO
Robert Bruce Jagow, Lockheed Missiles & Space Company, Inc., Sunnyvale, Calif.	Process for forming catalytic surfaces for wet oxidation reactions	4,052,302	JSC
Marvin D. Rhodes, NASA/LaRC Martin M. Mikulas, Jr., NASA/LaRC	Composite sandwich lettice structure	4,052,523	LARC
Frank J. Grunthaner, Blair F. Lewis, NASA/JPL Pasadena, Calif.	Photoelectron spectrometer with means for stabilizing sample surface potential	4,052,614	NRLO
Frank J. Nola, NASA/MSFC	Power factor control system for AC induction motors	4,052,648	MSFC
Satoshi Nagano, Caltech/JPL, Pasadena, Calif.	Overload protection system for power inverter	4,052,659	NRLO
John B. Schutt, NASA/GSFC Siegfried O. Auer, Nat. Academy of Sciences, Washington, D.C.	Remote sensing of vegetation and soil using microwave ellipsometry	4,052,666	GSFC
David H. Schaeffer, NASA/GSFC James P. Strong, III, NASA/GSFC	Memory device for two-dimensional radiant energy array computers	4,052,705	GSFC
William R. McClunney, NASA/GSFC	Two degree/90 degree laboratory scattering photometer	4,053,229	GSFC
Rudolf A. Schindler, NASA/JPL, Pasadena, Calif.	Interferometer mirror tilt correcting system	4,053,231	NRLO
Wendell D. Chase, NASA/ARC	Full color hybrid display for aircraft simulators	4,055,004	ARC
Arthur D. Adamson, Donald F. Sargisson, Charles L. Stotler, Jr., General Electric Co, Cincinnati, Ohio	Integrated gas turbine engine-nacelle	4,055,041	LERC
Otis L. Updike, Stanford University Stanford, Calif.	Apparatus for measuring a sorbate dispersed in a fluid stream	4,055,072	ARC

Edward L. Schriver, NASA/MSFC	Semiconductor projectile impact detector	4,055,089	MSFC
Peter C. Sakellaris, Univ. of Oregon Dental School, Portland, Ore.	Automatic fluid dispenser	4,055,147	ARC
Robert E. Oldrieve, Charles P. Blankenship } NASA/LeRC	Tantalum modified ferritic iron base alloys	4,055,416	LERC
Melvin R. Jackson, General Electric Company, Schenectady, N.Y.	Directionally solidified eutectic nickel-base superalloys	4,055,447	LERC
Stephan Stecura, Curt H. Liebert } NASA/LeRC	Thermal barrier coating system	4,055,705	LERC
Glen E. McDonald, NASA/LeRC	Selective coating for solar panels	4,055,707	LERC
John Dimeff, NASA/ARC	Optically selective, acoustically resonant gas detecting transducer	4,055,764	ARC
James M. Black, NASA/DFRC	Window comparator	4,055,777	DFRC
David L. Trowbridge, NASA/JPL, Pasadena, Calif.	Independent gain and bandwidth control of a traveling wave maser	4,055,810	NRLO
Pailmer N. Peters, NASA/MSFC Louis B. Holdeman, National Academy of Science, Washington, D.C.	Germanium coated microbridge and method	4,055,847	MSFC
Richard J. Stirn, NASA/JPL, Pasadena, Calif.	High voltage, high current schottky barrier solar cell	4,053,918	NRLO
Robert Steinberg, Donald L. Alger, Dale W. Cooper, } NASA/LeRC	Method of forming metal hydride films	4,055,686	LERC

Launches for 1978—Completed and Projected

Name	Launch Date	Vehicle	Range	Mission Remarks
Intelsat IVA-(F3)	Jan. 6	Atlas-Centaur	ETR	Improved communications satellite for Comsat. Reimbursable.
FLTSATCOM-A	Jan. 19	Atlas-Centaur	ETR	Navy fleet satellite communications. Reimbursable.
IUE-A	Jan. 25	Delta	ETR	International Ultraviolet Explorer—cooperative with ESA. Designed to obtain high resolution data on stars and planets in the ultraviolet region of the spectrum.
Intelsat IVA-F6	Feb.	Atlas-Centaur	ETR	Improved communications satellite for Comsat. Reimbursablie.
Landsat-C	March 5	Delta	WTR	Third Earth resources technology satellite.
Japan/BSE-A	March 23	Delta	ETR	Broadcasting satellite experimental. Japanese communications satellite for conducting TV broadcast experiments. Reimbursable.
AEM-1 (HCMM)	April	Scout	WTR	Heat capacity mapping mission to produce thermal maps for thermal inertial measurements, investigate feasibility of geothermal source location by remote sensing, and provide coverage of snow field for water runoff prediction.

Comstar-C	April	Atlas-Centaur	ETR	Third in a series of domestic communications satellites for Comsat. Reimbursable.
OTS-BU	April	Delta	ETR	ESA orbital Test Satellite.
NOAA/ GOES-C	May	Delta	ETR	Part of global network of geostationary environmental satellites to provide Earth imaging, monitor the space environment, and relay meterological data to users. Reimbursable.
TIROS-N	May	Atlas-F	WTR	Polar orbiting operational spacecraft to provide improve meteorological data for NOMSS and provide support to GARP.
Pioneer Venus-A	May	Atlas-Centaur	ETR	Planetary mission to Venus. Orbiter will measure upper atmosphere and ionosphere, study interaction between solar wind and ionosphere and magnetic field, study atmospheric and surface characteristics, determine gravitational field harmonics.
Seasat-A	May	Atlas-F	WTR	Sea satellite for global monitoring of ocean geoid, wave topography, surface wind speed and direction, ocean surface temperature, and ice field extent and dynamics.
ESA/GEOS-B	June	Delta	ETR	ESA spacecraft to conduct scientific investigation of waves and particles in magnetosphere. Reimbursable.
Japan Backup	June	Delta	ETR	Backup spacecraft for Japan. Reimbursable.
UK-6	July	Scout	WI	United Kingdom spacecraft to measure ultraheavy cosmic ray particles and study low-energy cosmic X-rays and the fast secular behavior of X-ray sources. Reimbursable.
ISEE-C	July	Delta	ETR	International Sun Earth Explorer. An extension of interplanetary studies with the spacecraft toward the Sun sufficiently outside the Earth's influence for comparison with results of ISEE-A and B missions and of probes to outer planets.
Nimbus-G	Aug.	Delta	WTR	Develop and flight test advanced sensors and technology basic to conducting experiments in the pollution monitoring, oceanographic, and meteorological disciplines.
Pioneer Venus-B	Aug.	Atlas-Centaur	ETR	Multiprobe—will determine nature and composition of clouds, composition structure and general circulation pattern of the atmosphere of Venus from the surface to high altitudes, study interaction between planetary environment and interplanetary medium.
Navy-20	Sept.	Scout	WTR	Navy navigation satellite. Reimbursable. (Call-up.)
NATO III-C	Sept.	Delta	ETR	Communications satellite, second in series.
NOAA-A	Sept.	Atlas-F	WTR	Advanced operational prototype spacecraft and sensors for a third generation series of operational meteorological satellites. Reimbursable.
HEAO-B	Oct.	Atlas-Centaur	ETR	Second high energy astronomical observatory to study highly energetic radiation from space.
Telesat-D	Nov.	Delta	ETR	Canadian domestic communications satellite. Reimbursable.
FLTSATCOM-B	Nov.	Atlas-Centaur	ETR	Navy fleet satellite communications. Reimbursable.

Inventions and Contributions Board Monetary Awards

The Inventions and Contributions Board has recommended that monetary awards be granted to the NASA employees identified on the attached list for scientific and technical contributions to space and activities. The recomendations were approved by the Administrator and awards have been made.

Innovator(s)	Title of Invention and Contribution
AMES RESEARCH CENTER	
James R. Jedlicka ..... LeRoy R. Guist ..... Richard M. Beam	Solid Medium Thermal Engine
Joseph R. Smith, Jr. ...	Ear Oximeter/Blood Pressure Transducer
Wayne H. Howard	Tread Drum for Animals
John Dimeff	Modulated Hydrogen Ion Flame Detector
JOHNSON SPACE FLIGHT CENTER	
William D. Sherborne ..	Nomex/Felt Thermal Protection System
Herbert S. Kobayashi .. Sydney P. Bradfield ...	Unbalanced Quadriphase Demodulator
Larry P. Ratcliff	Latch Mechanism
William C. Huber	Fluid Valve Assembly
Joseph M. Wood	Power Plexer
JOHN F. KENNEDY SPACE CENTER	
Otto H. Fedor	Risk Management System
LANGLEY RESEARCH CENTER	
James W. Mayo ..... Walter M. Cook, Jr. ...	Detector Panels-Micrometeoroid Detector
Thomas Vranas	High Temperature Strain Gage Calibration Fixture
Ira S. Hoffman	Miniature Biaxial Strain Transducer
Vernon L. Alley, Jr. ... Austin D. McHatton ...	Amplifying Ribbon Extensometer
Thomas G. Campbell ... Meredith W. Appleton ..	Omnidirectional Microwave Antenna
Daniel I. Sebacher ..... Alexander P. Sabol	Solar Hydrogen Generator
Charles M. Jackson .... Dallas G. Summerfield .	Wind Tunnel Model and Method
Theodore R. Creel, Jr. .. Robert A. Jones	Apparatus for Determining Thermophysical Properties of Test Specimens
LEWIS RESEARCH CENTER	
Americo F. Forestieri .. Anthony F. Ratajczak .. Leroy G. Sidorak	Solar Cell Shingle
William J. Anderson ...	Thrust Bearing
Harold S. Gold	Automotive Gas Turbine Fuel
Tito T. Serafini ..... Peter Delvigs ..... George R. Lightsey	Preparation of Polyimides from Mixtures of Monomeric Diamines and Esters of Polycarboxylic Acids
Jack A. Heller	Apparatus and Method for Reducing Thermal Stress In a Turbine Motor
MARSHALL SPACE FLIGHT CENTER	
Paul W. Howard ..... Luke A. Schutzenhofer .	Apparatus for Reducing Aerodynamic Noise in a Wind Tunnel
Charles C. Rupp ..... George L. von Pragenau	An Attitude Control System
Dwight Johnston	Wrist Joint Assembly
Van A. McAuley	Wide Band AC Modulated Control Network
Robert L. Krutz	A Holographic Motion Picture Camera
James R. Lowery	A Panel for Selectively Absorbing Solar Thermal Energy and the Method for Manufacturing the Panel
Billy R. Aldrich ..... William D. Whitt	General Purpose Rocket Furnace
BETA INDUSTRY	
Richard R. Corwin .... Joseph S. Kramer	Apparatus for Determining Thermophysical Properties of Test Specimens
BOEING COMPANY	
William N. Parsons .... Arthur W. Niergatth ... Clyde A. Medkief	Risk Management System
ELECTRO-OPTICAL SYSTEMS	
William J. Kearns	Mount for Thermal Control System
GENERAL ELECTRIC COMPANY	
Otis S. Moreman	Bearing Seat Usable In a Gas Turbine Engine
JET PROPULSION LABORATORY	
Richard B. Bolbly	Direct Reading Induced Meter
Melvin M. Saffren	Photon Excited Catalysis
Charles Elachi	Distributed Feedback Acoustic Wave Oscillator

M. Kudret Selcuk ..... A Solar Energy Collection System

Col. William T. McLyman Voltage Regulator Controller

Porter R. Ryason ..... Hydrogen Production by the Solar Photolysis of Water

Albert C. Knoell ..... Graphite Reinforced Bone Cement

LOCKHEED ELECTRONICS

George E. Proch ..... Low Distortion Receiver for Bi-Level Baseband PCM Waveforms

LOCKHEED MISSILES & SPACE COMPANY, INC.

Robert B. Jagow ..... A Process of Forming Catalytic Surface for Wet Oxidation Reactions

Murat H. Kural ..... Strain Arrestor Plate

McDONNELL DOUGLAS CORPORATION

Madeline S. Toy ..... Novel Polyperfluoropolyenes and Method of Manufacture

Madeline S. Toy .....
James M. Newman .... } New Polymers of Perfluorobutadiene and Method of Manufacture

NATIONAL RESEARCH COUNCIL

John Osmundson ..... A Length Controlled Stabilized Mode-Lock Nd: Yag Laser

ROCKWELL INTERNATIONAL CORPORATION

Lawrence E. Tannas ... One-Third Selection for Matrix Addressing Ferro-Electrics

Meyer M. Gilman ..... Flanged Major Modular Assembly Jig

Guillermo Lerma ..... Insulation for Piping

Walter T. Appleberry .. Load Regulating Latch

RCA CORPORATION

Walter L. Cable .....
Harold B. Dougherty .. } Rotary Solenoid Shutter Drive Assembly and Rotary Inertia Damper and Stop Plate Assembly

TRW SYSTEMS

Donald L. Cronin .....
Bertrand F. Farber ....
Hartmut K. Gehm .....
Donald S. Goldin ..... } Multiple High Voltage Output DC-to-DC Power Converter

UNIVERSITY OF NEBRASKA

Leendert Kersten ..... Wrist Joint Assembly

(from page 28)

Other researchers at Howard University's Cancer Research Center would like to compare the Lixiscope with existing X-ray techniques for preliminary screening of soft tissue tumors. "The device also shows promise for the detection of foreign bodies as well as for screening bone fractures," said Dr. Jack E. White, Head of Howard's Cancer Research Center.

According to White, use of the device for screening bone fractures could help cut down total X-ray dosages to the patient. Usual procedure now is to order X-ray images showing the limb or body from a variety of angles to insure that the proper aspect is covered.

The demonstration model of the Lixiscope was developed under direction of the Goddard technology utilization office as part of the NASA technology utilization program whose purpose is to identify and foster the transfer of promising aerospace technology for other uses.

Although the device is not on the market, it is estimated that production units could cost less than $5,000 each, based on existing component costs.

No new technology was required for the Lixiscope. In addition to the night vision image intensifier, it incorporates other off-the-shelf items including a radioactive source and an X-ray phosphor screen. The pull of a trigger unshields the radioactive source, sending a low dosage of X-rays into the object being examined. The X-rays passing through the object are absorbed by the phosphor screen which converts them to visible light.

The night vision unit, which employs fiber optics, intensifies and channels the visible light to its viewing screen for image display. Because of the high intensification capability of the unit, a small radioactive X-ray source of 10 to 20 millicuries can be used. Sources are interchangeable to facilitate use of the Lixiscope for a variety of applications.

Instant pictures of X-rayed objects can be made quickly with an attached camera, using a radioactive exposure a thousand times weaker than with a conventional X-ray machine.

Co-authors of Dr. Yin's paper, entitled "A Portable, Low-Dose, X-ray Imaging Device," include Dr. Jacob Trombka of the Goddard center and Stephen M. Seltzer, a consultant in theoretical calculations from the National Bureau of Standards.

Another Dividend from Air and Space

Research and development in aeronautics and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:

A Handheld X-Ray Device

A concept fostered by a NASA scientist for studying X-ray sources in space has led to the production of a handheld X-ray instrument that produces an instant image with a small source of radioactive material.

The new device is called a Lixiscope (for Low Intensity X-ray Imaging Scope). It is based on a concept under study in which research will be concentrated on energy sources in space and their conversion from X-rays to visible images.

Powered by a single pen-sized battery, the prototype model of the rugged device exhibits high potential for screening and other uses in medicine, dentistry and in certain kinds of industry. The most obvious promise of the unique unit is for emergency and other field use where a quick fluoroscopic examination is desirable. Potential applications of the portable instrument range from a field examination of bone injuries in athletes to detection of welding defects or gas leaks in pipes.

The device was developed by Dr. Lo I Yin, an X-ray researcher at NASA's Goddard Space Flight Center. He presented the first public details of the patented instrument Nov. 29 at a meeting of the American Nuclear Society in San Francisco, Calif.

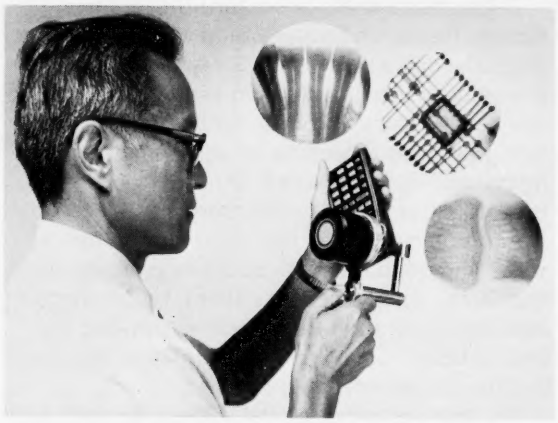
"The concept was not feasible until the declassification of an image intensifier developed by the Army's night vision laboratory at Ft. Belvoir, Virginia," Dr. Yin said.

"Any device developed for X-ray astronomy studies, where there is a scarcity of X-rays, should have technology of obvious value in medical fluoroscopy where there are many X-rays," Yin said.

Several research institutes in the dental and medical field are expected to participate in a cooperative effort to evaluate the Lixiscope. They include the National Institute of Dental Research (NIDR), Bethesda, Md., and Howard University's College of Dentistry, Washington, D.C. Others are the Cancer Research Center of Howard University's Medical School and Duke University Medical Center, Durham, N.C.

"The Lixiscope has a variety of potential applications, including patient screening, root canal analysis and possibly the monitoring of surgical procedures," said Dr. Richard Webber, Chief of NIDR's Clinical Investigations Branch. Researchers at NIDR already have designed one configuration of the new device to be tested for dental application.

(Continued on page 27.)



Dr. Lo I Yin examines a hand calculator with a demonstration model of his Lixiscope. Superimposed on the photo are images produced by the devices, including incisor teeth, integrated circuitry and the main joint of a forefinger.

NASA
National Aeronautics and Space Administration